REGISTRATION OF ANTIBIOTIC PROPHYLAXIS AT UROLOGY DEPARTMENT, AKER UNIVERSITY HOSPITAL

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Abstract

Background

Infection of the incised skin or soft tissues is common, but can be avoided by the use of antibiotic prophylaxis in surgery. Some bacterial contamination of a surgical site is inevitable, either from the patient's own bacterial flora or from the environment (1). The basic idea behind surgical wound prophylaxis is that antibiotics should already be in the tissue at the time the wound is inflicted. Administration of antibiotics inhibits growth of contaminating bacteria, and their adherence to tissues and to prosthetic implants, thus reducing the risk of infection (2). However antibiotics are not innocuous – apart from the cost, there is a substantial risk of allergy, up to and including death from anaphylaxis as well as development of resistance. The aim of antimicrobial prophylaxis in urological surgery is to prevent infective complications resulting from diagnostic and therapeutic procedures. There is no single-handed guideline for the use of antibiotic prophylaxis at Aker University Hospital.

Method

Between January 2004 and June 2004, 177 surgical procedures were studied at Oslo Urological University Clinic at Aker University Hospital. By reviewing medical, anaesthetic and nursing records, and medication charts, the antibiotic choice, duration of prophylaxis, dose and timing of the first dose was recorded.

Findings

The timing and duration of the antibiotic prophylaxis were incorrect in many cases. Among those who received prophylaxis, 41.5 % (39/94) were given prophylaxis after the time of incision, and the mean duration of prophylaxis was 5.2 days with a range of 0 days and 14 days. There was also a variation in the dosage and type of antibiotic used in prophylaxis for the same kind of surgeries.

Interpretation

The evidence on the best choice of antibiotics and prophylactic regimens is limited. Most studies in the past have been poorly designed and have lacked statistical power. Obviously, there is a need for evidence-based guidelines, in order to standardize the antibiotic prophylaxis at Aker University Hospital.

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Introduction

Infection of the incised skin or soft tissues is a common but avoidable complication of any surgical procedure. Some bacterial contamination of a surgical site is inevitable, either from the patient's own bacterial flora or from the environment (1). The basic idea behind surgical wound prophylaxis is that antibiotics should already be in the tissue at the time the wound is inflicted. It has long been realised that some patients are at far greater risk of developing wound infection than others.

Administration of antibiotics inhibits growth of contaminating bacteria, and their adherence to prosthetic implants, thus reducing the risk of infection (2). However antibiotics are not innocuous – apart from the cost, there is a risk of allergy, including death from unexpected anaphylaxis as well as the development of resistance.

177 surgical procedures performed between January 2004 and June 2004, were studied at Oslo Urological Clinic at Aker University Hospital. By reviewing medical, anaesthetic and nursing records, and medication charts, the antibiotic choice, duration of prophylaxis, dose and timing of the first dose was recorded.

Goals of antibiotic prophylaxis

The goals of prophylactic administration of antibiotics to surgical patients are to:

- Reduce the incidence of surgical site infections
- Use antibiotics in a manner that is supported by evidence of effectiveness
- Minimize the effect of antibiotics on the patient's normal bacterial flora
- Minimize adverse effects
- Cause minimal change to the patient's host defences

It is important to emphasize that antibiotic prophylaxis is related to, not a substitute for, good surgical technique. Antibiotic prophylaxis should be regarded as one component of an effective policy for the control of nosocomial infection. Some of the characteristics of an optimal antibiotic for surgical prophylaxis could be listed as follows:

- Effective against suspected pathogens
- Does not induce bacterial resistance
- Effective tissue penetration
- Minimal toxicity
- Minimal side effects
- Long half life
- Cost effective

Factors affecting the incidence of surgical site infection

Previously it had been shown that if one classified the operation according to how «dirty» it was, then one could predict the likelihood of infection.

Classification of operation:

Operations can be categorised into four classes (table 1) with an increasing incidence of bacterial contamination and subsequent incidence of postoperative infections (3).

Table 1:

Clean
Clean-contaminated
Contaminated
Dirty

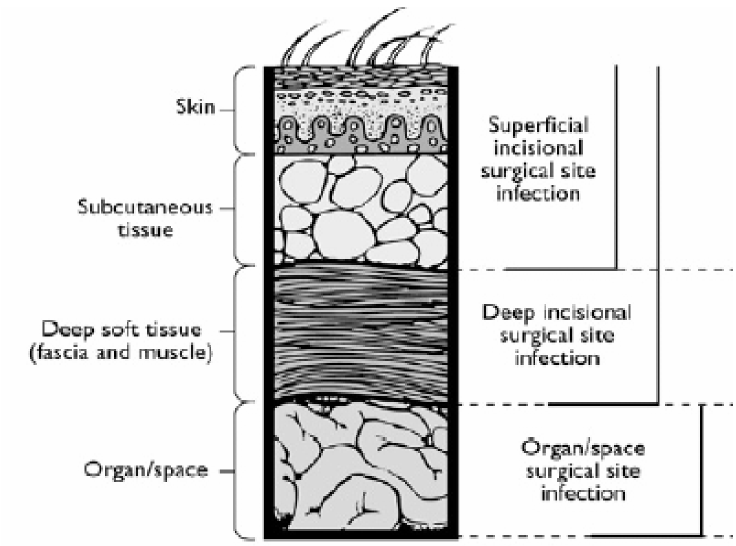
- Clean: elective surgery, no acute inflammation or transection of gastrointestinal tract, oropharyngeal, genitourinary, biliary or tracheobronchial tract, no break in aseptic technique, examples include craniotomy, orthopedic surgery, cardiothoracic and vascular surgery, antibiotic use is controversial, but routinely used. Examples in urologic surgery: orchiplexy and nephrectomy.
- Clean-contaminated: urgent or emergent case that is otherwise clean, controlled opening of gastrointestinal tract, oesopharyngeal, genitourinary, biliary or tracheobronchial tracts, minimal spillage and/or minor aseptic technique break, examples include invasive head and neck surgery, cholecystectomy, urologic procedures, hysterectomy, orthopedic surgery with prosthesis, antibiotics are administered for prophylaxis. Examples in urologic surgery: endoscopic procedures in patients without indwelling catheters, radical cystectomy, and radical prostatectomy.

- Contaminated: any procedure in which there is gross soiling of the operation field during procedure, as well as surgery of open traumatic wounds (<4 hours old), examples include colorectal surgery with spillage, biliary or genitourinary tract surgery in the presence of infected bile or urine and clean or clean-contaminated procedures with major break in aseptic technique, antibiotics are administered for prophylaxis. Examples in urologic surgery: all the examples in urologic surgery above with concomitant urinary tract infection, bladder augmentation using colon, and surgery for vesicovaginal fistula.
- Dirty: pus or abscess present, preoperative perforation of gastrointestinal tract, oropharyngeal, biliary, or tracheobronchial tracts, penetrating trauma (>4 hours old), examples include perforated appendicitis with abscess formation, antibiotics are utilized for treatment, therefore use is not considered prophylaxis. Examples in urologic surgery: surgery for pyonephrosis and surgery for colovesical fistula.

It would be a simplification to estimate the wound infection rate only from this classification, but it gives a good idea of the likelihood of infection. Young fit patients with contaminated or dirty wounds may recover from the infection far more often than predicted from the wound classification in itself. Older patients with sick organs undergoing clean surgery might have a far higher infection rate. One must include the other factors that determine wound infection (and thus the need for antibiotic prophylaxis). But first a definition of the surgical wound infections:

- Infection identified by purulent or culture positive drainage isolated from any structure above the fascia in proximity to the surgical wound.
- Deep infections are characterized by purulent drainage from subfascial drains, wounds bursting open, or abscess formation and involve adjacent sites manipulated during surgery
- Wound dehiscence
- Breakdown of the surgical wound

Figure 1:



As the number of virulence of contaminating bacteria increase, so does the chance for the development of a postoperative infection. Surgical trauma to the tissues and the use of foreign material further potentiate the risk of infection, whereas systemic and local host immune mechanisms function to contain inoculated bacteria and prevent infection. Antibiotics in the tissues provide a pharmacologic means of defence that increase the natural host immunity. Bacterial resistance mechanisms may contribute to wound infection by enabling organisms to escape from the prophylactically administered antibiotics (4, 5).

One can imagine the environment of the surgical wound as a balance or equation between different factors as shown in equation 1. An increase in the factors above the line also increases the chance for the development of a postoperative infection. General and local host immune mechanisms function to contain inoculated bacteria and prevent infection. Antibiotics in tissues help the natural host immunity.

Equation: Determinants of surgical wound infections

$$\text{Risk of surgical wound infection} \sim \frac{\text{Microbial concentration and virulence} \times \text{Injury to tissue} \times \text{Foreign material} \times \text{Resistance to preoperative antibiotics}}{\text{General and local host immunity} \times \text{Perioperative antibiotics}}$$

The identified risk factors:

Incidence of a surgical wound infection depends on numerous factors specific to either the procedure itself or the individual patient. These include type of surgical procedure and bacterial load encountered, underlying medical condition of the patient, and surgical procedure (technique, duration, patient preparation, equipment preparation etc.)

- Patient risk factors: Systemic factors such as diabetes, remote infections, corticosteroids, obesity, extreme of age, malnutrition, massive transfusion, and multiple preoperative co-morbid medical diagnosis: ASA class 3, 4 or 5. The American Society of Anaesthesiologist (ASA) has devised a preoperative risk score based on the presence of co-morbidities at the time of surgery (Table 2) (6). An ASA score >2 is associated with increased risk of wound infection and this risk is additional to that of classification of operation and duration of surgery (3).

Table 2: ASA classification of physical status

ASA score	Physical status
1	A normal healthy patient
2	A patient with a mild systemic disease
3	A patient with a severe systemic disease that limits activity, but is not incapacitating
4	A patient with an incapacitating systemic disease that is a constant threat to life
5	A moribund patient not expected to survive 24 hours with or without operation

- Patient risk factors: Local factors such as foreign body, electrocautery, injection with noradrenalin, wound drains, hair removal with razor, and previous irradiation of site.
- Surgery-related factors: Such as type of procedure, site of surgery, emergent surgery, duration of surgery (>60-120 min), previous surgery, timing of antibiotic administration, placement of foreign body (hip/knee replacement, heart valve insertion, shunt insertion), hypotension, hypoxia, dehydration and hypothermia, surgeon preparation.
- Wound-related factors: Magnitude of tissue trauma and devitalisation, blood loss, haematoma, wound classification, presence of drains, packs, or drapes as well as ischemia, and wound leakage.
- Diagnostic procedure-related factors in urology: Ultrasound guided core biopsy of the prostate has become one of the most frequent diagnostic tools in urology, aimed at

diagnosing early prostate cancer. It is a quick, low-invasive procedure, but associated with a fairly high risk of infection (7, 8). Whereas cystoscopy rarely leads to an infectious complication (9).

Table 3, is derived from a large epidemiological study and illustrates the relation between risk index and operation classification (10). The two risk factors used here are co-morbidity (ASA score >2) and duration of operation (>75th percentile):

Risk index 0: When neither risk factor is present

Risk index 1: When either one of the risk factor is present

Risk index 2: When both risk factors are present

Table 3: Probability of wound infection by type of wound and risk index (3)

Operation classification	Risk index		
	0	1	2
Clean	1.0%	2.3%	5.4%
Clean-contaminated	2.1%	4.0%	9.5%
Contaminated	3.4%	6-8%	13.2%

Here we can see that a clean operation with risk index 2 has a probability of 5.4 % for the likelihood of wound infection, as opposed to a contaminated operation with no risk index that has a probability of 3.4 % for wound infection.

Indication for surgical antibiotic prophylaxis:

This section reviews some aspects of the present controversies related to the prophylactic use of antimicrobial agents in urologic diagnostic and therapeutic procedure. Health care associated infections in urologic surgery are summarised in the following table:

Table 4: (11)

- 1 Surgical site infection
  a. Superficial
  b. Deep
- Urinary tract infection
  a. Asymptomatic bacteriuria
  b. Symptomatic urinary tract infection
  c. Complicated urinary tract infection or febrile upper urinary tract infection
  d. Pyelonephritis
- Blood stream infection - septicaemia
- Infection at a remote site

The mostly feared complication in urologic surgery are deep surgical site infections, complicated urinary tract infection, pyelonephritis and septicaemia, all which represent a threat for the patient at an increased cost to society.

A summary of the expected rates of infection related to some standard urological procedures are given in Table 5:

Table 5: Expected rate of infection in conjunction with urologic surgery, expressed in % based mainly on references (11-15)

Procedure	**Infection rates (reported/expected)**			
	No antibiotic Prophylaxis			**With antibiotic prophylaxis**
	Bacteriuria/ UTI	**Febrile/ UTI**	**Sepsis**	**Rates of Febrile UTI/sepsis**
Diagnostic procedures				
Core biopsy of the prostate	20-53	5-10	1-5	<5
Cystoscopy, urodynamic examination	<20	<5	No data	No impact
Ureteroscopy	No data			No impact demonstrated
Endourologic procedures and ESWL				
ESWL	<5	<5	1	Minimal impact
TURP	6-70	5-10	<5	66-71% reduction
Ureteroscopy (complicated) percutaneous stone surgery	<38	4-25	<5	
Open surgery	UTI	SSI	Sepsis	
Clean (nephrectomy)	Catheter associated	<2	No data	No impact demonstrated
Clean-contaminated (open urinary tract; bowel segment)	Catheter associated	5-10	<3	2-3
Implant of prosthetic devices	Catheter associated	1-16	No data	1-3

No data indicates limited or no data available for that specific intervention. UTI= Urinary Tract Infection, SSI=Surgical Site Infection, ESWL= Extracorporeal shock wave lithotripsy, TURP= transurethral resection of the prostate

Administration of intravenous prophylactic antibiotics

Appropriate antibiotic use for prevention of surgical wound infection includes the following: appropriate timing of administered agents and repeated dosing based on the length of the procedure and antibiotic half life. One may consider re-dosing if procedure exceeds 4 hours. The selection of the agent must be based on the procedure that is performed, and against the organisms most likely to be encountered. It must therefore cover both the endogenous organisms related to the type of surgical procedure performed, and the exogenous organisms introduced secondary to poor surgical technique. To avoid infection and decrease the potential for development of resistance, it is important to have the appropriate duration. Antibiotic prophylaxis is usually not indicated for patients with sterile urine, because the postoperative infection risk is small (16).

- Choice of antibiotics; although a wide range of organisms can cause infection in surgical patients, surgical site infection is usually due to a small number of common pathogens. Thus the antibiotics selected for prophylaxis must cover the common pathogens (17) (table 6). Antibiotics used in antibiotic prophylaxis should be different from antibiotics used in treatment, but the drug in prophylaxis is also often used in treatment. Past history of a serious adverse event (allergy) and a comprehensive risk assessment should be part of the process of choosing the appropriate antibiotic (18).

Table 6

Escherichia coli, Proteus mirabilis, Enterococci, Pseudomonas spp., Staphylococci spp., Candida spp.

One can use many types of antibiotics for these criteria e.g. second-generation cephalosporins, fluoroquinolones and aminopenicillins combined with a Beta-lactamase inhibitor. High-risk patients and those who are allergic to Beta-lactams can use aminoglycosides (19).

- Timing of administration; because the antibiotic must be present in the tissue at the time the infecting organism arrives, timing is crucial. The period of risk for surgical site infection begins with the incision. The time taken for an antibiotic to reach an effective concentration in any particular tissue reflects its pharmacokinetic profile and the route of administration (20). Prophylaxis should be started within 30 minutes of the induction of anaesthesia. In theory, if prophylactic antibiotic is given prematurely or too late, the result will be subeffective concentrations of the drug within the damaged and poorly perfused tissue because of shock, hypoxia, or vasoconstriction during surgery, thereby allowing survival and proliferation of the bacteria. Classen et al. demonstrated that patients receiving antibiotics either too early or postoperatively had more infections than patients receiving it prior to incision time (21).

- Duration of prophylaxis; many drugs used in prophylaxis have relatively short half lives (1-2 hours in studies of normal volunteers). In such situations it may therefore seem logical to give an additional dose of prophylaxis during operation that last for more than 2-4 hours (22). However, in comparison with normal volunteers, patients undergoing surgery have slower clearance of drugs from their blood (23). Antibiotics should not be continued for over 24 hours (24). Procedures in which there is rapid blood loss and/or fluid administration will require more frequent prophylactic dosing. When focus of infection cannot be eliminated by the operation or in case of severe contamination, the administration of antibiotics may exceed for more than one day, it is then considered to be therapeutic not prophylaxis.
- Intravenous administration of antibiotic prophylaxis immediately before or after induction of anaesthesia, 30 (-60) minutes before the incision, is the most reliable method for ensuring effective serum antibiotic concentrations at the time of surgery. But some oral antibiotics can be equally as effective as intravenous antibiotics (25).
- The dose of an antibiotic required for prophylaxis is the same as that for the therapy of infection.

Recommendation of prophylaxis according to the type of the urological procedure:
The procedures are divided into three categorized groups; open procedures, endoscopic-instrumental procedures, and diagnostic procedures, with regards to antibiotic prophylaxis (26).

- Open operations: urinary tract including bowel segments, urinary tract without bowel segments, operations outside the urinary tract e.g. implants for penis and sphincter, testicular prosthesis, reconstructive genital operations
- Endoscopic- instrumental operations: urethra, prostate, bladder, ureter and kidney, percutaneous litholapaxy, ESWL, laparoscopic operations
- Diagnostic interventions: prostate biopsy (transrectal, perineal), urethrocystoscopy, ureterorenoscopy, percutaneous pyeloscopy, laparoscopic procedures

Antibiotic prophylaxis is usually recommended in urological surgery with the use of bowel segments. In urological surgery without the use of bowel segments, antibiotic prophylaxis is not generally required unless the patient has an increased risk of infection (page 8: identified risk factors), or before a TURP if there is a history of a urinary tract infection. For urologic procedures outside the urinary tract, prophylaxis is generally not recommended. Exceptions are in long reconstructive genital operations or with implant surgery. In endoscopic-instrumental operations, perioperative antibiotic prophylaxis is recommended only in cases with increased risk of infection. Diagnostic interventions: perioperative antibiotic prophylaxis is generally recommended in transrectal prostate biopsy with a thick needle. In the other diagnostic procedures antimicrobial prophylaxis is only recommended in high-risk patients. If the patient has indwelling catheter, stent, nephrostomy etc. postoperatively, prolongation of perioperative prophylaxis is contraindicated.

Controversies in antibiotic prophylaxis in urology:

Although there are a number of reports that show the benefit of the use of prophylaxis for reduction of postoperative mortality (27, 28), it is important to underline that urologic diagnostic and therapeutic procedures can induce surgical site infections, bacteriuria, pyelonephritis and septicaemia in a substantial number of patients, too great to be neglected. As patients are different and have various risk factors, a careful assessment of the patient and its individual risk is crucial. The pathogens and their susceptibility pattern vary extensively in Europe so that no clear European recommendations as for the choice of antibiotics can be given. Prophylaxis and treatment should be adjusted according to the local resistance pattern. The resistance situation in Norway is favourable; therefore old fashioned and cheap antibiotics can be used (34). Basic principles of antibiotic prophylaxis in terms of timing, mode of administration and length of regiment apply for urologic interventions. It is therefore the task of the urologists to carefully assess each individual patient and procedure to make a choice for an optimal prophylaxis (11). The final decision regarding the benefits and risks of prophylaxis for an individual patient will depend on:

- The patient’s risk of surgical site infection
- The potential severity of the consequences of surgical site infection
- The effectiveness of prophylaxis in that operation
- The consequences of prophylaxis for that patient

Results from the antibiotic prophylaxis registration at Aker University Hospital, Oslo Urological University Clinic:

177 surgeries conducted during a six-month period were evaluated by reviewing medical, anaesthetic and nursing records, and medication charts for each patient. The antibiotic choice, duration of prophylaxis, dose and timing of the first dose was recorded on special schemes. The majority of the patients were males (85 %) and the mean length of hospital stay was 8.7 [1, 44] days. Most of the surgeries were elective. Patients, who were under treatment with antibiotics before the surgery, accounted for 8.6 % (15) of the total procedures, and they were excluded from prophylaxis analysis. If no antibiotic prescriptions had been recorded, it was assumed that antibiotics were not given. If data on a certain parameter of the antibiotic prescription were lacking, this was classified as missing data on this parameter only. The operations were categorized as on pages 12-13. Group A is open operations: urinary tract including bowel segments, urinary tract without bowel segments, operations outside the urinary tract e.g. implants for penis and sphincter, testicular prosthesis, reconstructive genital operations. Group B is endoscopic- instrumental operations: urethra, prostate, bladder, ureter and kidney, percutaneous litholapaxy, ESWL, laparoscopic operations. Group C is urethrocystoscopy, and group D the testicular operations. Table 7 shows the timing of the antibiotic prophylaxis given in the different groups. Preoperative is defined as before time of incision (within 24 hours); perioperative is defined between time of incision and the end of the operation. Postoperative is defined as the time after the operation is finished. In group A, 19 (27.5 %) procedures were given preoperative antibiotic prophylaxis and 13 (18.8 %) were given prophylaxis after the time of the first incision. In group B, 34 (43 %) procedures was given preoperative antibiotic prophylaxis and 25 (31.6 %) were given prophylaxis after the time of the first incision. In group C no prophylaxis was given. In group D, there is usually no indication for giving prophylaxis, but in the 3 (12 %) cases where prophylaxis was given, the indication for giving prophylaxis was because of prosthesis, scrotal haematoma and traumatic capsule rupture. In 16 (9 %) cases, timing could not be evaluated, either because the moment of the first incision, or the moment of the administration of the first antimicrobial dose, could not be retrieved from the records.

Table 7:

	A	B	C	D	*Total*
Preoperative	19	34		2	55
Perioperative	9	3			12
Postoperative	4	22		1	27
Non given	24	15	2	19	60
No data	1	4	1	1	7
Excluded	12	1	1	2	16
Total	69	79	4	25	177

Table 8 shows the duration of the antibiotic prophylaxis in the days after the surgery. In group A, the mean duration of antibiotic prophylaxis after the operation was 2.5 days with a range of 0 days and 11 days. The same mean duration for group B and D, was respectively 7.2 days < 0, 14 > and 2.5 days < 1, 7 >.

Table 8:

	A	B	D
Mean duration (in days)	2.5	7.2	2.5
<Range>	< 0, 11 >	< 0, 14 >	< 1, 7 >

Table 9 shows the drug and the first dose given for prophylaxis in the 6 different groups. Antibiotic prophylaxis is used in all surgeries with the use of bowel segments and in 96% of laparoscopic radical prostatectomy surgeries. Group IV and V; contain many different types of surgeries and that may to some extent explain the wide amount of variation in the different types of antibiotics chosen for the prophylaxis. In two of the procedures, antibiotic prophylaxis with Ampicillin and Gentamicin against endocarditis was used. Metronidazol, Gentamicin, Ampicillin, and Trimethoprim were the drugs most frequently used in combination with other antibiotics. The most common drug used was Trimethoprim. As one can see from the table, there are for example 7 different regiments for prophylaxis just for group II, excluding the endocarditis regiment and the doses varies. In conclusion, use of antibiotics follows the patterns of recommendations, but there are still differences in the dosage and choice of drugs.

Table 9: **I** Surgery with the use of bowel segments, **II** Laparoscopic radical prostatectomy, **III** Testicular operation, **IV** Open surgeries,

V Endourological, **VI** Urethra surgery, genital reconstruction

Indications	I	II	III	IV	V	VI
Drug (first dose given):						
Yes	10	50	4	13	11	6
No		1	19	21	15	6
Unknown		1				
Metronidazol + Doxycyclin						
1000 mg x 2 + 200 mg x 1	1					
1000 mg x 1 + 200 mg x 1	6			1		
1500 mg x 1 + 200 mg x 1	1					
1500 mg x 1 + 400 mg x 1	2					
Trimethoprim						
160 mg x 1		40		1		1
160 mg x 2		4			1	3
300 mg x 1					1	
Ofloxacin						
200 mg x 1		1				
300 mg x 1		1	1		1	
Trimethoprim + Ofloxacin						
160 mg x 1 + 300 mg x 1		1				
Metronidazol + Cefuroxim						
1000 mg x 1 + 1500 mg x 1		1				
1500 mg x 1 + 1500 mg x 1				1		
Ampicillin						
1000 mg x1						1
1000 mg x 4					1	
2000 mg x 2		1				
2000 mg x 3				1		
Trimethoprim + Ampicillin + Gentamicin						
160 mg x 1 + 2000 mg x 2 + 320 mg x 1		1				
Trimethoprim + sulfamethoxazole – Trimethoprim						
160 mg x 2 + 2 tablets x 2						1
Ciprofloxacin						
250 x 1				1		
250 mg x 2			1			
400 mg x 1				1	1	1
400 mg x 4				1		
Cefalotin						
2000 mg x 1			1			
Erythromycin						
500 mg x 2			1			
Mecillinam						
400 mg x 1					2	
Gentamicin						
320 mg x 1				1	2	
Cefuroxim						
1500 mg x 1					1	
Gentamicin + Mecillinam						
440 mg x 1 + 200 mg x 3					1	
Cefalexin						
1000 mg x 2				1		
Ciprofloxacin + Cefuroxim						
500 mg x 2 + 1500 mg x 1				1		
Ampicillin + Gentamicin						
2000 mg x 1 + 300 mg x 1				1		
Ciprofloxacin + Metronidazol						
400 mg x 1 + 1500 mg x 1				1		
Ampicillin + Metronidazol						
2000 mg x 1 + 1500 mg x 1				1		

Discussion

The use of antimicrobial agents is different from the use of other pharmaceutical agents. It is not only based on the characteristics of a patient and a drug, but also on the characteristics of the bacteria or the infection one is trying to prevent. Activity of the antibiotic drug is counteracted by the development of resistance by the pathogen, but also by exposed colonising flora. Antimicrobial use is a major determinant for the development of resistance (29). It is therefore important to optimize the use of antimicrobial drugs (30).

The major problem in collecting the data from the patient records was lack of documentation of the exact time for when the prophylaxis was given. To perform an audit on patient records is also time consuming. Good planning, knowing what to look for, and making distinct goals are of great importance before starting with the audit. There was no clinical guideline for antibiotic prophylaxis at Aker University Hospital (Urology department), when we performed the study.

From the data collected, 29 of 48 (60.4 %) patients undergoing laparoscopic radical prostatectomy received prophylaxis preoperative, 19 of 48 (39.6 %) patients received prophylaxis postoperatively, and one received none for the same procedure. There was a lack of a clear indication in the timing of the first dose; this may possibly be related to logistics in the surgical group, the arrival time at the operating rooms, the type of anaesthesia used, or most importantly lack of guidelines.

Antibiotic prophylaxis should not be continued for over 24 hours (24). Many studies have shown that a single dose of an antimicrobial drug is sufficient for most surgical procedures. Inappropriate use of prophylaxis is often due to prolonged administration. The mean duration of prolonged prophylaxis at Aker was too long. Excessive duration of antibiotic use during the postoperative period may be due to the surgeon’s thought of the necessity of providing «extra protection» due to risk from serum lines, tubes or catheters, or because of the impossibility of differentiating infection from contamination and inflammation from another site.

There are also differences in the dosage and choice of drugs applied for the same procedures.

Clinical guidelines are becoming increasingly popular as a mean of influencing clinicians’ practice. This is particularly true of guidelines for antibiotic usage. They have several aims: to reduce variations in the methods and standards of care; to improve the appropriateness of care; to improve the quality of care; to reduce the costs of care; to improve the cost-effectiveness of care; in the case of antibiotic guidelines, to control, or even reduce, the levels of resistant organisms; to serve as educational tools; and to promote evidence-based decision making (31). It is therefore important to introduce clinical guidelines for antibiotic usage.

Given the recent worldwide escalation in resistance and the overwhelming evidence of much over-use of antibiotics (and thus unnecessary resistance), the practical and essential approach to the control of antibiotic resistance is to control antibiotic use. However knowledge about existing guidelines and alignment of the guidelines according to current evidence is not enough to guarantee good antibiotic use in either surgical prophylaxis or therapeutic intervention.

The most recent guidelines from European Association of Urology came out in March 2006 (32). They also emphasize the need for evidence-based guidelines, because of controversies in antibiotic prophylaxis within urology.

After this thesis, a guideline in urology at Aker University hospital was issued in June 2006 (33).

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